# SYED AMMAL ENGINEERING COLLEGE

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Dr. E.M.Abdullah Campus, Ramanathapuram – 623 502.

## Department of Electrical and Electronics Engineering


## *Question Bank*
## *EE 6503 Power Electronics*

| # | Question | Mark |
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| | **UNIT I POWERSEMI-CONDUCTOR DEVICES** | |
| 1. | Compare the switching speed of Thyristor and a power MOSFET. *(AU-TVL/EEE-Dec 2009)* | **2** |
| 2. | Define circuit turn off time. | **2** |
| 3. | Define dv/dt and di/dt rating of devices. | **2** |
| 4. | Define holding current. *(AU-Chennai/EEE-Dec 2009)* | **2** |
| 5. | Define latching current of an SCR. *AU-Chennai/EEE-Dec 2009)* | **2** |
| 6. | Define latching current. *AU-Chennai/EEE-Dec 2010)* | **2** |
| 7. | Define PIV rating of a diode? | **2** |
| 8. | Define power electronics | **2** |
| 9. | Define power transistors | **2** |
| 10. | How a Thyristor can be protected against excess di/dt? | **2** |
| 11. | How can a thyristor turned off? | **2** |
| 12. | IGBT is a voltage controlled device. Why? | **2** |
| 13. | Mention any four applications of the power electronics. | **2** |
| 14. | Power BJT is a current controlled device. Why? | **2** |
| 15. | Power MOSFET is a voltage controlled device. Why? | **2** |
| 16. | What are different types of SCR turn on methods? | **2** |
| 17. | What are the different methods to turn on the thyristor? | **2** |
| 18. | What are the different types of power MOSFET? | **2** |
| 19. | What are the factors that influence the turn-off time of a BJT? | **2** |
| 20. | What are the factors that influence the turn-off time of a IGBT? | **2** |
| 21. | What are the factors that influence the turn-off time of a MOSFET? | **2** |
| 22. | What are the factors that influence the turn-off time of a thyristor? *(AU-Chennai/EEE-Dec 2009)* | **2** |
| 23. | What is a snubber circuit? *(AU-Chennai/EEE-May2009)* | **2** |
| 24. | What is inverter grade SCR? How does it differ from converter, grade SCR? | **2** |
| 25. | What is second breakdown in a power transistor? | **2** |
| 26. | What is the difference between latching current and holding current in SCR? | **2** |
| 27. | What is the special feature of GTO? | **2** |
| 28. | What is the turn-off time for converter grade SCRs and inverter grade SCRs? | **2** |
| 29. | What losses occur in a thyristor during working conditions? | **2** |
| 30. | Why circuit turn off time should be greater than the thyristor turn-off time? | **2** |
| 31. | Why is SCR known as a latching device? | **2** |
| 32. | Why MOSFETs are not preferred for high frequency applications? | **2** |
| 33. | Write short notes on a part which makes the switching device to a power level from signal level? | **2** |
| 34. | Describe the various methods of thyristor turn on. | **6** |
| 35. | Brifly discuss the V-I characteristics of SCR. | **8** |
| 36. | Compare MOS &bi-polar power transistors in terms of its operation and its characteristics. | **8** |
| 37. | Compare MOSFET AND BJT in detail | **8** |
| 38. | Discuss with neat sketch, series operation of thyristors and parallel operation of thyristors. | **8** |
| 39. | Draw and explain the thyristor gate drive circuit. | **8** |
| 40. | Explain briefly about DIAC | **8** |
| 41. | Explain briefly about TRIAC | **8** |
| 42. | Explain the four modes of operation of a triac using diagram. | **8** |
| 43. | Explain the operation of SCR with its static characteristics and discuss the different regions of operation in the characteristics. | **8** |
| 44. | Explain the switching characteristics of BJT. | **8** |
| 45. | Explain the switching characteristics of MOSFET. | **8** |
| 46. | Mention the Various classifications of switching device and give example. | **8** |
| 47. | What is a snubber? Explain the need and operation of snubbers for power electronic switches. | **8** |

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| 48. | What is the need of snubber in transistor circuit? Explain the over voltage snubber. | **8** |
| 49. | Based on two transistor analogy , explain the turn on mechanism of an SCR. Also, derive an expression for the anode current. | **10** |
| 50. | Explain the transient model of BJT. | **10** |
| 51. | Calculate the losses in a MOSFET switch with the following operating conditions. Voff = 300 V; Ion = 2 A; fsw = 50 kHz; Ton = 0.5T. Assume MOSFET with the following specifications: tr = 21nsec, tf = 50nsec, Von 2V, Ioff = 250microA. | **16** |
| 52. | Describe about any one drive circuit and snubber circuit for MOSFET. | **16** |
| 53. | Describe the construction of TRIAC with aid of diagram and explain its characteristics. | **16** |
| 54. | Describe the construction of TRIAC with aid of diagram and explain its VI and Switching characteristics. | **16** |
| 55. | Draw the basic structure of IGBT and explain the transient characteristics. | **16** |
| 56. | Explain briefly about the construction and working of power BJT with the switching Characteristics. | **16** |
| 57. | Explain briefly about various commutation of thyristor in detail. | **16** |
| 58. | Write short notes on a) Conduction power loss of a semiconductor switch, b) Thermal resistance of a semiconductor, c) Protection circuits of a SCR. | **16** |
| | **UNIT II PHASE-CONTROLLED CONVERTERS** | |
| 1. | Define active power | **2** |
| 2. | Define converter. | **2** |
| 3. | Define displacement factor | **2** |
| 4. | Define displacement factor of a single phase converter. | **2** |
| 5. | Define extension angle | **2** |
| 6. | Define form factor | **2** |
| 7. | Define power factor | **2** |
| 8. | Define pulse number. | **2** |
| 9. | Define reactive power. | **2** |
| 10. | Define Ripple factor. | **2** |
| 11. | Explain the need for long duration gate pulses in controller with the inductive loads. | **2** |
| 12. | Give an expression for average voltage of single phase semi converters. | **2** |
| 13. | Mention some of the applications of controlled rectifier. | **2** |
| 14. | Mention the condition between the firing angle and the extension angle to achieve continuous conduction | **2** |
| 15. | Mention the condition for effective voltage control in single phase ac voltage controller with thyristors. | **2** |
| 16. | Mention the gate pulse requirements of SCR for a highly inductive load? | **2** |
| 17. | Mention the role of free-wheeling diode. | **2** |
| 18. | What are the advantages of single phase bridge converter over single phase mid-point converter? | **2** |
| 19. | What are the advantages of six pulse converter? | **2** |
| 20. | What are the advantages of using freewheeling diode in a voltage fed Converter bridge? | **2** |
| 21. | What are the applications of AC chopper? | **2** |
| 22. | What are the types of commutation? | **2** |
| 23. | What is a dual converter? | **2** |
| 24. | What is a line commutation? | **2** |
| 25. | What is commutation angle or overlap angle? | **2** |
| 26. | What is extinction angle? | **2** |
| 27. | What is half controlled thyristor bridge? | **2** |
| 28. | What is meant by commutation? | **2** |
| 29. | What is meant by delay angle? | **2** |
| 30. | What is meant by forced commutation? | **2** |
| 31. | What is meant by input power factor in controlled rectifier? | **2** |
| 32. | What is meant by natural commutation? | **2** |
| 33. | What is meant by phase controlled rectifier? | **2** |
| 34. | What is ON –OFF control in ac voltage controllers? | **2** |
| 35. | What is the difference between semi controlled and fully controlled rectifiers? | **2** |
| 36. | What is the effect of source inductance on the operation of an AC to DC converter? | **2** |
| 37. | What is the function of freewheeling diodes in controlled rectifier? | **2** |
| 38. | What is the inversion mode of controlled rectifiers? | **2** |

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| 39. | What is two quadrant operations? | **2** |
| 40. | What Type of commutation is used in SCR AC voltage controller employing phase angle control techniques? | **2** |
| 41. | Write short notes on the effect of source inductance. | **2** |
| 42. | Write the expression for the average output voltage in a three phase fully controlled rectifier? | **2** |
| 43. | A single phase AC voltage controller is connected to a resistive load of 5 ohms. The supply voltage is 230V.Estimate the rms load voltage and RMS load current for a delay angle of 120 degrees. | **8** |
| 44. | A single phase full converter fed from 220V, 50Hz supply gives an output voltage of 180V at no load. When loaded with a constant output current of 10A, the overlap angle due to source inductance is found to be 6¢ª. Compute the value of source inductance. | **8** |
| 45. | A single phase full converter feeding RLE load has the following data. Source voltage = 230V, 50Hz, R =2.5 ohms, E=100 V, firing angle = 30¢ª. The load inductance is large enough to make the load current constant. Compute a) the average value of the load voltage and load current, b) the input power factor. Also draw the time variations of load voltage, load current and current through one thyristor. | **8** |
| 46. | Compare the the performance parameters of a 1 phase half & fully controlled converter. | **8** |
| 47. | Discuss briefly about the performance parameters of a 1 phase fully controlled converter. | **8** |
| 48. | Discuss briefly about the performance parameters of a 1 phase half controlled converter. | **8** |
| 49. | Discuss the effect of source inductance on the converters. | **8** |
| 50. | Draw the circuit diagram of a.c chopper using triac and explain the operating principle . | **8** |
| 51. | Explain the operation of single phase fully controlled converter with circuit diagram. Sketch the output voltage waveform for resistive load and inductive load. | **8** |
| 52. | Mention the performance parameters of the converter. | **8** |
| 53. | What is an ac chopper? Draw neat circuit diagram for single phase ac chopper using thyristors and its load voltage waveform. Explain its operation. Derive an expression for RMS value of output voltage of an AC chopper. | **8** |
| 54. | What is dual converter? Explain the operation of a dual converter with neat circuit diagram. What are the different modes of operation of dual converter? | **8** |
| 55. | With neat sketch, describe the function of half controlled single phase bridge rectifier with resistive and inductive (RL) load of asymmetrical configuration. Draw the waveforms observed and explain. | **8** |
| 56. | With neat sketch, describe the function of half controlled single phase rectifier with resistive load. What will be the wave forms observed? | **8** |
| 57. | A 6 pulse converter connected to the source of 415 V,50 Hz is supplying 460 V, 200 A, D.C. load. Calculate a) firing angle required, á (alpha) b) D.C power c) A.C line current d)R.M.S value of device current. | **16** |
| 58. | A single phase fully controlled thyristor bridge converter supplies o load consists of R, L ,Vc. the output current may be considered to be virtually constant. If the RMS supply voltage = 220V, load resistance = 5 Ù, the output current idc = 10A. Determine: (a) Firing angle á if EC = 135V. (b) á if EC = -145V. (c) Which source (ac or dc) is supplying power in (a) or (b). (d) Draw the load voltage waveform for (a) & (b). | **16** |
| 59. | A single phase fully controlled thyristor bridge converter supplies o load consists of R, L ,Vc. the output current may be considered to be virtually constant. If the RMS supply voltage = 220V, load resistance = 5 Ù, the output current idc = 10A. Determine: (a) Firing angle á if EC = 150V. (b) á if EC = -120V. (c) Which source (ac or dc) is supplying power in (a) or (b). (d) Draw the load voltage waveform for (a) & (b). | **16** |
| 60. | Derive an expression for the average output voltage of 3 phase fully controlled bridge converter explaining its operation and waveforms. | **16** |
| 61. | Derive an expression for the average output voltage of 3 phase fully controlled bridge converter for ¥á =60¢ª with R load. Explain its operation and waveforms. | **16** |
| 62. | Derive an expression for the average output voltage of 3 phase fully controlled bridge converter for ¥á >60¢ª with R load. Explain its operation and waveforms. | **16** |
| 63. | Describe the working of 1 phase fully controlled bridge converter in the Rectifying mode and inversion mode. And derive the expressions for average output voltage and rms output voltage. | **16** |
| 64. | Discuss briefly about Single phase full controlled converters with necessary circuit diagrams and voltage derivation | **16** |
| 65. | Discuss briefly about Single phase half controlled converters with necessary circuit diagrams and voltage derivation | **16** |
| 66. | Draw three phase half controlled rectifier with resistive R load and its vector diagram of three phase voltage .In continuous mode (for 0<¥á<60¨¬), enumerate average load voltage , average load current and the RMS load voltage . What will be the wave forms observed in conduction mode as well as discontinuous conduction? | **16** |

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| 67. | Metion the classification of the controlled rectifier in detail | **16** |
| 68. | What is 3 phase dual converter? Explain the operation of a dual converter with neat circuit diagram. What are the different modes of operation of dual converter? | **16** |
| 69. | What is dual converter? Explain the operation of a dual converter with neat circuit diagram. What are the different modes of operation of dual converter? | **16** |
| | **UNIT III DC TO DC CONVERTER** | |
| 1. | Define dc transformer. | **2** |
| 2. | Define duty cycle of a chopper. | **2** |
| 3. | Define hard switching. | **2** |
| 4. | Define turn on and turn off time of a chopper. | **2** |
| 5. | Give two applications of DC chopper-circuits. | **2** |
| 6. | Mention the applications of chopper. | **2** |
| 7. | Mention the applications of resonant switching converters. | **2** |
| 8. | Mention the category of SMPS | **2** |
| 9. | Mention the control strategy adopted to chopper. | **2** |
| 10. | Mention the difference between normal chopper with respect to regulated chopper. | **2** |
| 11. | What are the advantages of resonant switching in converters? | **2** |
| 12. | What is a step down chopper? | **2** |
| 13. | What is chopper frequency? What is the practical value of chopper frequency? | **2** |
| 14. | What is time ratio control? | **2** |
| 15. | What is two quadrant operations in chopper? | **2** |
| 16. | Write down the relationship between input and output voltage and current of a step up chopper? | **2** |
| 17. | A step down DC chopper is connected to a resistive load of 5 ohms. The DC supply voltage is 100 V. ON time and OFF time of the chopper are 6ms and 4ms respectively. Determine the duty ratio, chopping frequency, average load voltage and average load current. | **8** |
| 18. | Describe the principle of step-down chopper. Derive an expression for the average and rms output Voltage in terms of input dc voltage & duty cycle. | **8** |
| 19. | Describe the principle of step-up chopper. Derive an expression for the average and rms output Voltage in terms of input dc voltage & duty cycle. | **8** |
| 20. | Discuss briefly about the performance parameters of the chopper | **8** |
| 21. | Explain in detail the working principle of a step up chopper. Draw necessary waveforms. | **8** |
| 22. | Explain the basic principle and advantages of resonant converters. Describe the operation of any one type of resonant switch based converter in detail. | **8** |
| 23. | Explain the different control strategies used in choppers. | **8** |
| 24. | Explain the operation of a step down DC chopper feeding R-L load with a neat circuit and waveforms. | **8** |
| 25. | Explain the operation of buck-boost converter and derive the expression for the average output voltage. | **8** |
| 26. | Mention the condition to achieve the continuous inductor current and capacitor voltage. | **8** |
| 27. | A step down chopper has a input voltage of 220V and the output voltage of 660V. if the non conducting time of thyristor is 80 µsec. compute the pulse width is halved for a constant frequency operation, find the new output voltage. | **16** |
| 28. | A step up chopper has a input voltage of 220V and the output voltage of 660V. if the non conducting time of thyristor is 100 µsec. compute the pulse width is halved for a constant frequency operation, find the new output voltage. | **16** |
| 29. | Discuss briefly about boost converter and derive its necessary equations with neat sketch | **16** |
| 30. | Discuss briefly about Buck converter and derive its necessary equations with neat sketch | **16** |
| 31. | Discuss briefly about Buck-boost converter and derive its necessary equations with neat sketch | **16** |
| 32. | Explain briefly about the resonant switching converters | **16** |
| 33. | For class A chopper with RLE load, find the expression for minimum load current, maximum load current, average load current, rms load current, average source current and rms switch current. | **16** |
| | **UNIT IV INVERTERS** | |
| 1. | Define modulation index in pulse width modulation employed in inverter? | **2** |
| 2. | Define the term inverter gain. | **2** |
| 3. | Differentiate between VSI and CSI. | **2** |
| 4. | List a few industrial applications of inverters? | **2** |

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| 5. | List different methods of controlling the output voltage of inverters. | **2** |
| 6. | Mention any two advantages of current source inverter? | **2** |
| 7. | What are the advantages of FACTS. | **2** |
| 8. | What are the advantages of PWM inverter? | **2** |
| 9. | What are the methods of reducing harmonics in inverters? | **2** |
| 10. | What is a current source inverter? | **2** |
| 11. | What is a voltage source inverter? | **2** |
| 12. | What is PWM inverter? | **2** |
| 13. | Explain how inverter can be controlled using multiple and sine PWM techniques. | **8** |
| 14. | What is PWM? List the various PWM techniques and explain any one of them. | **8** |
| 15. | With a neat circuit and relevant waveforms discuss the operation of an ideal single phase CSI. | **8** |
| 16. | Write short note on series resonant inverter. | **8** |
| 17. | Describr the working of a 1 phase full bridge inverter supplying R, RL loads with relevant circuit and waveforms. | **16** |
| 18. | Discuss briefly and compare the various methods employed for the control of output voltage and harmonic control of inverters. | **16** |
| 19. | Discuss the functioning of three phase voltage source inverter supplying a balanced star connected load in 120 degree operating mode. | **16** |
| 20. | Explain the following PWM techniques in inverter. i) Sinusoidal PWM ii)Multiple PWM | **16** |
| 21. | Explain the operation on-line and off-line UPS in detail. | **16** |
| 22. | Explain the principle of operation of three phase inverter operating in 180 degree conduction mode with necessary waveforms. Also obtain the expression for line to line voltages. | **16** |
| 23. | What is the need for controlling the output voltage of inverters? Classify the various techniques adopted to vary the inverter gain and brief on sinusoidal PWM. | **16** |
| 24. | With relevant waveforms, explain the working of a current source inverter. | **16** |
| | **UNIT V AC TO AC CONVERTERS** | |
| 1. | What is the difference between ON-OFF control and phase control? | **2** |
| 2. | What is the advantage of ON-OFF control? | **2** |
| 3. | What is the disadvantage of ON-OFF control? | **2** |
| 4. | What is the duty cycle in ON-OFF control method? | **2** |
| 5. | What is meant by unidirectional or half-wave ac voltage controller? | **2** |
| 6. | What are the disadvantages of unidirectional or half-wave ac voltage controller? | **2** |
| 7. | What is meant by bidirectional or half-wave ac voltage controller? | **2** |
| 8. | What is the control range of firing angle in ac voltage controller with RL load? | **2** |
| 9. | What type of gating signal is used in single phase ac voltage controller with RL load? | **2** |
| 10. | What are the disadvantages of continuous gating signal? | **2** |
| 11. | What is meant by high frequency carrier gating? | **2** |
| 12. | What is meant by sequence control of ac voltage regulators? | **2** |
| 13. | What are the advantages of sequence control of ac voltage regulators? | **2** |
| 14. | What is meant by cyclo-converter? | **2** |
| 15. | What are the two types of cyclo-converters? | **2** |
| 16. | What is meant by step-up cyclo-converters? | **2** |
| 17. | What is meant by step-down cyclo-converters? | **2** |
| 18. | What are the applications of cyclo-converter? | **2** |
| 19. | What is meant by positive converter group in a cyclo converter? | **2** |
| 20. | What is meant by negative converter group in a cyclo converter? | **2** |
| 21. | What does ac voltage controller mean? | **2** |
| 22. | What are the applications of ac voltage controllers? | **2** |
| 23. | What are the advantages of ac voltage controllers? | **2** |
| 24. | What are the disadvantages of ac voltage controllers? | **2** |
| 25. | Draw the circuit diagram of three phase to single phase cycloconverter and explain its operation with waveforms | **16** |
| 26. | With the necessary circuit diagram and wave forms, explain the principle of operation of single phase ac voltage controller having only thyristor feeding resistive load by on-off control and phase control. Derive the expression for rms value of output voltages in both cases. | **16** |

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| 27. | Describe the operation of single phase full wave AC voltage controller with the help of voltage and current waveform. Also derive the expression for average value of output voltage. | **16** |
| 28. | Explain the operation of the step down cycloconverter both bridge and midpoint configuration with necessary waveforms. | **16** |
| 29. | With aid of circuit diagram, explain the operation of three phase to three phase cycloconverter employing three phase half wave circuits and list few of its applications. | **16** |
| 30. | Explain the principle of working of single phase to single phase step up cycloconverter. List the factors that affect the performance of cycloconverters. | **16** |
| 31. | Discuss the working of a single phase AC voltage controller with RL load when its firing angle is more than the load power factor angle. Illustrate with waveforms. | **16** |